

Feb. 28, 1933.

G. F. HOUSTON

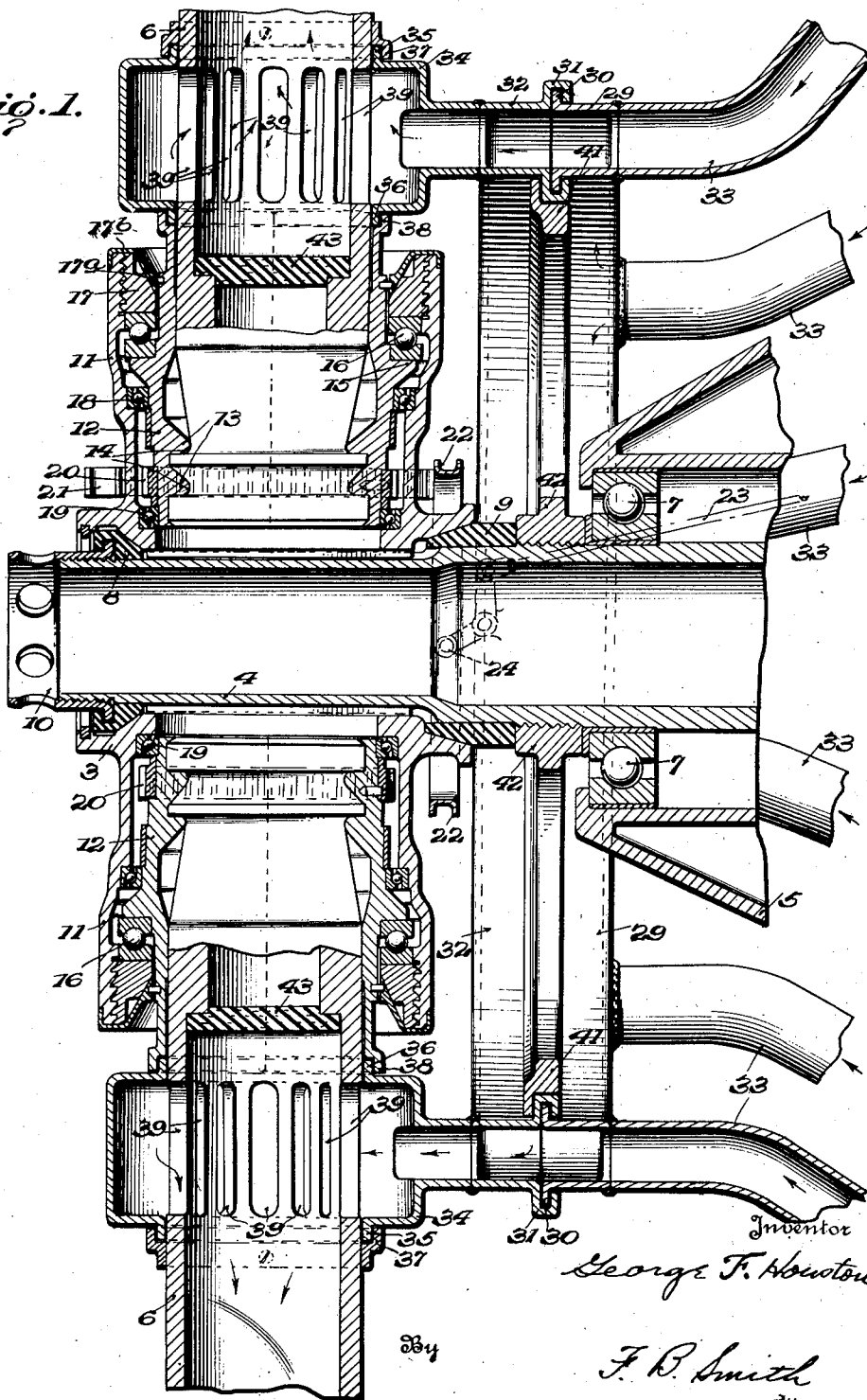
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PROPELLER

Filed Aug. 4, 1930

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Fig. 1.



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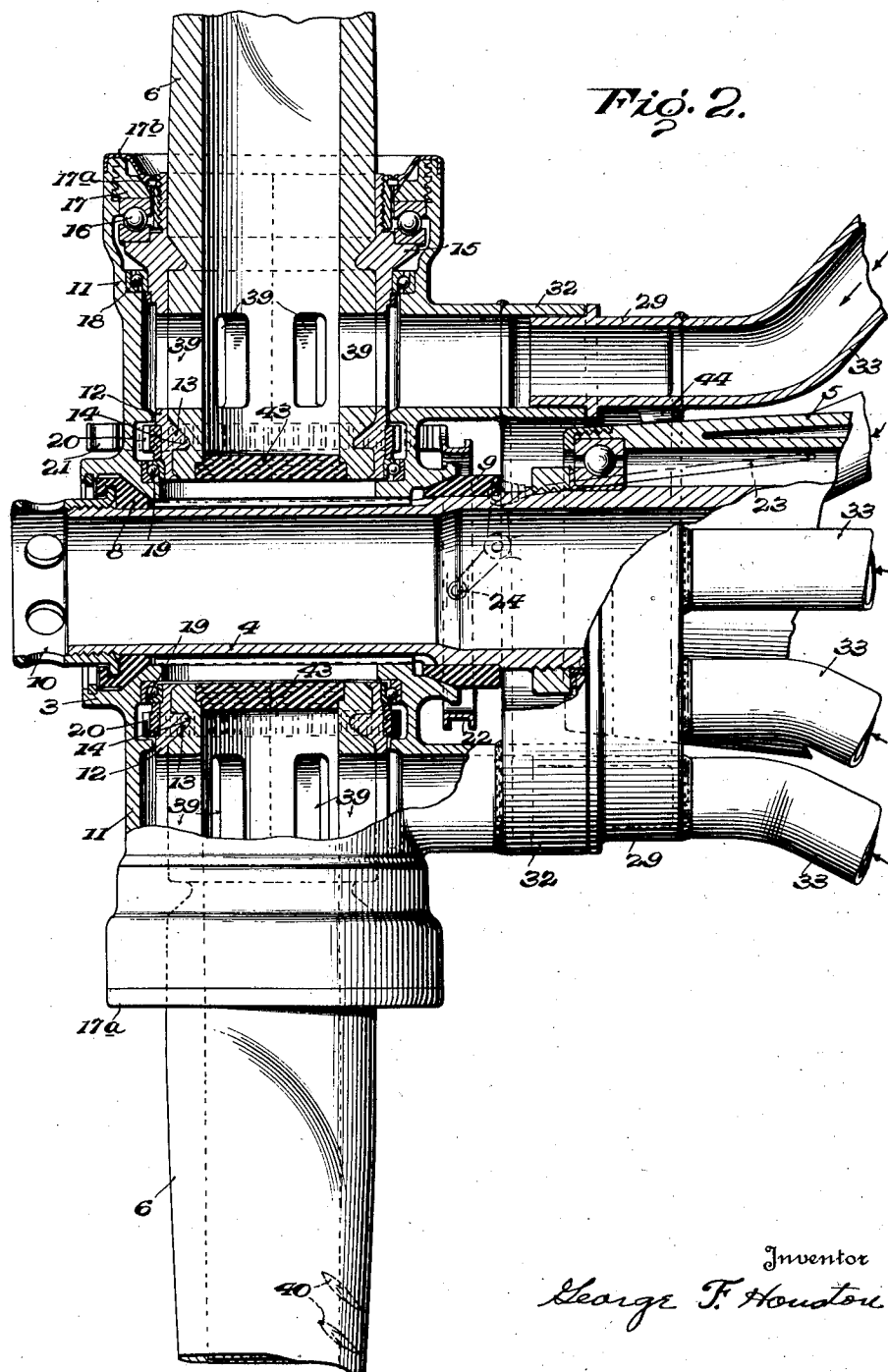
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PROPELLER

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This invention relates to propellers and more particularly to propellers through the blades of which fluid is adapted to be exhausted.

5 Heretofore, it has been proposed to provide propellers with means enabling fluid to be passed through the blades and numerous advantages and increased efficiencies in operation have been realized by the use of such propellers, especially in instances of aircraft installations, wherein the fluid may comprise the exhaust gases of an internal combustion engine. In installations of the last-mentioned character, various means have been employed whereby the rotating hollow blades may be operatively connected with the exhaust passages of the engine to enable the gases therein to be led to the atmosphere through the blades.

20 It is one of the objects of the present invention to provide a novel propeller construction wherein fluid is exhausted through the blades thereof.

25 It may be highly desirable, in certain instances wherein, for example, a fluid-exhausting propeller is employed on aircraft, to provide means for varying the angularity or pitch of the blades while the propeller is in operation, there resulting from such combination not only an increased engine efficiency due to the exhausting of the gases through the propeller blades, but also a greatly increased propeller efficiency because of the reduction in skin friction due to the fluid issuing from said blades and an increased propeller thrust and other increased effective forces due to the variable pitch feature.

35 It is accordingly another object of the present invention to provide a novel propeller including fluid-exhausting means together with means to vary the pitch of the blades while the same are rotating.

40 Another object is to provide in an aircraft propeller, novel means enabling the engine exhaust gases to be discharged through the propeller blades.

45 A further object is to provide in an exhaust gas propeller, novel means for heat insulating the driving shaft and bearings therefor from the heated exhaust gases.

A still further object is to provide in a propeller, a novel arrangement of parts whereby the exhaust gases from an internal combustion engine may be discharged to atmosphere through the blades thereof and wherein the blades may be rotated, during operation, about their longitudinal axes to vary the pitch, the said arrangement being compact, light in weight and easily assembled.

55 The above and other objects of the invention will appear more fully hereinafter from the following detailed description when taken in connection with the accompanying drawings. It is to be expressly understood, however, that the drawings are for purposes of illustration only and are not to be taken as a definition of the limits of the invention, reference being had for this purpose to the appended claims.

60 In the drawings, wherein like reference characters refer to like parts throughout the several views:—

Figure 1 is a vertical section illustrating one form of propeller constructed in accordance with the present invention; and

75 Figure 2 is a view similar to Figure 1 illustrating a slightly modified form of the invention.

Referring more particularly to Figure 1, the present invention is illustrated as being embodied in a propeller having a hub 3, drivably connected to a shaft 4, which latter may be driven by an engine, a forwardly extending stationary portion of which is shown at 5, the said hub being adapted to support a plurality of hollow blades 6 through which the exhaust gases from the engine are conducted by means to be particularly referred to hereinafter.

80 The shaft 4, rotatably supported with respect to said engine portion 5 by means of bearings 7, is provided forwardly of said bearings, with spaced split front and rear cones 8 and 9, each provided with beveled faces for intimately engaging corresponding faces of the hub for properly positioning the same. The hub is maintained in proper position with respect to the cones and shaft, by any suitable means such as a nut 10 threadedly received by the outer end of the

shaft and which may be locked in position if desired.)

In order to drivably connect the hub 3 with the blades 6, the former is provided with two or more radially extending sockets 11 in which the root ends of said blades are rotatably supported. As shown, each blade root end has clamped thereon, a split sleeve 12, provided internally with a plurality of annular shear shoulders 13 adapted to be received in corresponding recesses 14 on the blade root, and externally with an annular shoulder 15 forming a seat for a ball thrust bearing 16 the other seat therefor co-operating with a ring nut 17 threaded into the open end of the socket. Packing means 17^a and a cap member 17^b co-operating therewith, may be provided in order to prevent seepage of oil from the bearing 16 outwardly.

Means are provided for varying the pitch or angularity of the hollow blades while the propeller is rotating. To this end the split sleeve 12, carrying each blade is rotatably supported in the socket 11 by means of ball bearings 18 and 19, and between such bearings and secured to the sleeve in a suitable manner is a ring gear 20 constantly in mesh with a longitudinally movable rack 21 extending through suitable apertures provided in the hub socket. It will be understood that a rack is provided for each blade and that movement of said racks axially of the driving shaft will rotate the blades about their longitudinal axes to vary their angularity or pitch.

In order to impart such movement to the racks during rotation of the propeller, the inner end of each rack is suitably secured to an externally grooved annular member 22 concentrically arranged with respect to the shaft 4. As will be understood, the member 22 rotates with the propeller assembly. Any suitable non-rotatable means capable of longitudinal movement with respect to the driving shaft, may be employed for shifting said member 22 and the toothed racks connected thereto, laterally, to effect rotation of the blades in their respective sockets. As shown, such means may comprise a rod 23 connected through a suitable pivoted bell crank, the end of which is provided with a member 24 extending into the grooved outer periphery of the member 22.

Means are provided for conducting the exhaust gases from the engine to the interior of said hollow blades and thence to atmosphere, and such means are preferably so arranged as to be operable not only during periods of operation wherein the pitch of the blades remains unchanged, but also during such time in operation, when the pitch-changing mechanism is being operated to effect an alteration in the blade angularity. In the form of the invention illustrated, such means include a stationary collector ring 29 which may be provided with a circumferential outwardly-

extending flange 30 over which a flange 31 formed on a rotating collector ring 32 is adapted to be spun or otherwise operated upon in order to form a substantially frictionless and gas-tight joint. A plurality of exhaust pipes 33, leading to engine exhaust manifold or engine cylinders (not shown), are suitably secured, as by welding, to the stationary ring, and a manifold 34, one for each blade and encircling the same, is secured to the movable ring 32 in a similar manner.

Each manifold 34 has an upper and lower flange 35 and 36 respectively which co-operate with corresponding flanges 37, carried by the blade, and 38, formed on the sleeve 12, to form substantially gas-tight joints. As indicated in Figure 1, the exhaust gases, during rotation of the propeller, will flow in the direction of the arrows through a plurality of slots 39 arranged adjacent the root end of the blade, and axially thereof to the atmosphere through a plurality of angularly arranged apertures 40, Figure 2, located adjacent the trailing edge of the blade. If desired, a supporting member 41 having a hub 42 threaded on the driving shaft and rotating therewith, may be employed for suitably supporting the collector rings 31 and 32.

In order to prevent the heat of the exhaust gases from affecting the bearings provided in the hub, a member 43 having heat-resistant and heat-insulating qualities as for example a phenolic condensation product, is suitably positioned within and adjacent the inner end of each propeller blade as by passing the same into place. Such member is effective to confine the heated exhaust gases in that portion of the blade wherein high temperatures will not seriously affect any of the working parts.

Referring more particularly to Figure 2, there is disclosed therein a slightly modified form of the invention, wherein a specially constructed propeller hub is employed, enabling the exhaust gases to be conducted through the hub and thence through the blades to atmosphere. By such an arrangement, a more compact structure is realized, it being apparent from an inspection of this figure that the collecting rings are of less diameter than those utilized in connection with the structure disclosed in Figure 1.

As shown, each hub socket 11 has integrally formed therewith an inwardly extending tubular extension which is adapted to be suitably secured as by welding, to the rotatable collector ring 32. The stationary collector ring 29 telescopes within the rotatable ring and may be supported on the engine extension 5 as by means of ribs 44. The remaining elements comprising the combination disclosed in the alternative form, Figure 2, are similar to those described in detail in connection with Figure 1.

During operation of either form of the invention, it will be seen that as soon as the propeller is rotated, centrifugal force will be effective to withdraw the exhaust gases from the engine cylinders and discharge same to the atmosphere through the apertured blades. When it is desired to vary the pitch of the blades, axial movement of the rod 23 will cause a corresponding axial movement of each of the toothed racks 21, through movement of the member 22, such movement of the racks being effective to rotate the ring gears 20, securely attached to each blade and thus rotate the latter in their respective sockets.

There has thus been provided by the present invention a novel propeller construction wherein the exhaust gases of an engine may be conducted through the blades thereof to the atmosphere and wherein the pitch of the blades may be varied at will, during operation, and without interfering with the discharge of the exhaust gases. By combining these two features into one compact structural arrangement, an unusually efficient construction is attained and one in which maximum engine and propeller efficiency may be secured at all times. The provision of the heat-insulating member within the blade between the exhaust gases and the interior of the hub, permits the propeller assembly to be operated without fear of any danger of bearings being burned out because of the high heat content in the exhaust gases.

Though there has been illustrated and described only two embodiments of the invention, it is to be expressly understood that the same is not limited to the forms shown, but may be embodied in various mechanical alternatives. For example, means other than the gear and rack mechanism may be employed for changing the pitch of the blades while in operation. It is also to be understood that various other changes may be made in the sizes, shapes and relative locations of the component parts of the propeller without departing from the spirit of the invention, as will be understood by those skilled in the art. Reference will therefore be had to the appended claims for a definition of the limits of the invention.

What is claimed is:

1. In an aeroplane propeller having a plurality of hollow blades, means for rotating said propeller, means for conducting the exhaust gases from an engine to said hollow blades and means for varying the pitch of said blades while the propeller is rotating.

2. A propeller for aircraft comprising a rotatable shaft, a plurality of hollow blades drivably connected with said shaft, means for rotating the blades about their longitudinal axes to vary the pitch thereof while the propeller is rotating and means for leading

the exhaust gases from an engine to the interior of said hollow blades.

3. In combination, a propeller having a plurality of hollow blades, means for rotating said propeller, means for continuously maintaining said hollow blades in communication with the exhaust manifold of an engine and means for varying the angularity of said blades while the propeller is rotating.

4. In combination with an internal combustion engine of the type having an exhaust gas manifold and adapted to rotate a propeller shaft, a plurality of hollow blades drivably connected to said shaft said blades being provided with openings, means for leading exhaust gases from said manifold to said hollow blades whereby during operation said gases will be exhausted to the atmosphere through said openings, and means for varying the pitch of said blades during rotation thereof.

5. A propeller comprising a hub, means including an engine for rotating the hub, a plurality of hollow blades carried by the hub, means for changing the pitch of said blades during rotation of the propeller, means for conducting the exhaust gases from the engine to said hollow blades at points remote from the hub and a heat insulating member within each blade for heating insulating said hub from said gases.

6. A propeller comprising a hub, means including an engine for rotating the hub, a plurality of hollow blades carried by the hub, means for changing the pitch of said blades during rotation of the propeller and means for conducting the exhaust gases from the engine to said hollow blades at points remote from the hub said means including a collector ring, and a manifold encircling each blade and connected to said ring.

7. A propeller comprising a hub, means including an engine for rotating the hub, a plurality of hollow blades carried by the hub, means for changing the pitch of said blades during rotation of the propeller, means for conducting the exhaust gases from the engine to said hollow blades said means including a collector ring, a manifold encircling each blade and connected to said ring, and a heat insulating member within each blade for heat insulating said hub from said gases.

8. In combination with a propeller having a plurality of hollow blades, an engine for rotating said propeller, a stationary collector ring communicating with the engine exhaust, a rotatable collector ring communicating with said first-named ring, means including hollow members encircling each blade for establishing communication between the interior of said blades and the rotatable ring, and a heat insulating member carried by and closing the inner end of each blade.

9. In an aeroplane propeller of the type

- having a hollow hub communicating with the exhaust of an engine, a plurality of hollow apertured propeller blades carried by said hub and communicating therewith whereby during rotation of the propeller exhaust gases will be conducted through said hub and blades to the outside air, and means for changing the pitch of the blades at will during operation of the propeller.
- 10 10. In a propeller having a plurality of apertured hollow blades, a hub, means for rotating said hub, means including bearings for rotatably supporting said blades in said hub, means including a manifold member encircling each blade for continuously maintaining the interior thereof in communication with an exhaust manifold of an engine, a member associated with the inner end of each blade for heat insulating the exhaust gases from said bearings, and means for rotating said blades about their longitudinal axes to vary the pitch while said blades are being rotated by the hub.
- 15 11. A propeller having in combination, a rotatable shaft, engine means for rotating the shaft, a plurality of apertured hollow blades, a hub drivably connected with the shaft, and rotatably carrying said blades, means for continuously maintaining the interior of said blades in communication with the exhaust passages of the engine said means including a stationary collector ring, a rotatable collector ring and connections integral with the hub for connecting the hub and said last-named ring, members within each blade for heat insulating the exhaust gases from the rotatable shaft, and means for rotating said blades in said hub to vary the pitch thereof during operation of the propeller.
- 20 12. An exhaust gas propeller having a plurality of hollow blades, means including a shaft and an engine for rotating said blades, means for varying the pitch of the blades during such rotation, means for conducting the exhaust gases from said engine to each of said hollow blades and heat-resistant elements positioned within each of said blades for preventing the heat from the exhaust gases from being conducted to said shaft.
- 25 13. A propeller comprising a rotatable shaft, a hub drivably connected to said shaft, a plurality of apertured hollow blades rotatably carried by said hub, means for rotating said blades in said hub to vary the pitch thereof, and a manifold encircling each blade and communicating with a portion of the apertures therein for conducting fluid into said blades.
- 30 14. A propeller comprising a rotatable shaft, a hub drivably connected to said shaft, a plurality of hollow blades rotatably carried by said hub, means for rotating said blades in said hub to vary the pitch thereof, each of said blades being provided with a plurality of apertures adjacent the root end thereof, and a manifold encircling each blade adjacent said apertures.
- 35 15. A propeller comprising a rotatable shaft, engine means for rotating said shaft, a plurality of hollow apertured blades drivably connected to said shaft, a manifold encircling each of said blades and communicating with a portion of the apertures therein, and connections between said manifolds and the exhaust of said engine.
- 40 16. A propeller comprising a rotatable shaft, engine means for rotating said shaft, a plurality of hollow apertured blades drivably connected to said shaft, a manifold encircling each of said blades and communicating with a portion of the apertures therein, a rotatable collector ring communicating with said manifolds and a stationary collector ring communicating with said rotatable collector ring and the exhaust of said engine.
- 45 In testimony whereof I have signed this specification.
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